



Seldon: Probing Terrorist Mitigation Strategies

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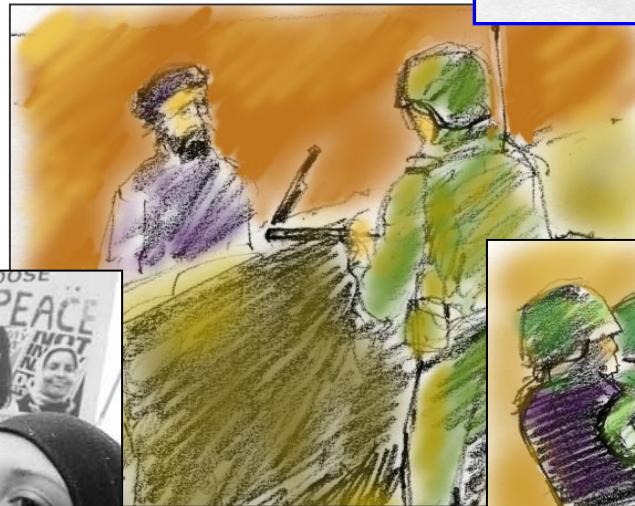
Sandia National Laboratories
February 23, 2004

Future Threat Environment

Peacekeeping strategic w

Asymmetric, fast, distributed

**Complex interdependencies
ambiguities, vulnerabilities**





Example of Future Threat Organization

Global Salafi Jihad (GSJ)

Use of violence against foreign non-Muslim governments or population in furtherance of Salafi objectives to overthrow the far 'Satan' as a means of going after the near.

- Al Qaeda
- Egyptian Islamic Jihad
- Jemaah Islamiyah
- Abu Sayyaf Group
- Moroccan Salafia Jihadia
- Al Tawhid



Stemming the Tide of Terrorism

How might we better develop strategies to mitigate terrorism?

- Understanding of the [path](#) to terrorism will allow us to:
 - Disrupt processes that lead to terrorists
 - Identify how and where we can most effectively disrupt that path
 - Find and stop the bad guys
 - Identify characteristics of individuals at different places along the path
 - Focus interdiction resources



Analysis of Global Salafi Jihad

- **Researcher: Marc Sageman, *MD PhD***
 - **Forensic Psychiatrist**
 - **Lecturer, Soloman Asch Center at UPenn**
 - **Author of *Understanding Terror Networks* (2003)**
- **Analysis of 172 Mujahedin biographies based on:**
 - **Transcripts of trials in U.S., France, Germany, Egypt, Indonesia, and Morocco**
 - **International press accounts**
 - **Academic publications**



Theories of Terrorism Not Applicable to GSJ

- ~~Poverty~~
- ~~Religious education~~
- ~~Parents or culture~~
- ~~Immaturity~~
- ~~Ignorance~~
- ~~No job skills~~
- ~~Single males~~
- ~~Criminals~~
- ~~Pathologies~~
- ~~Recruited~~
- Middle Class+
- Secular Education
- Non-Fanatical Upbringing
- Grown Men (Few Teens)
- Educated (HS+)
- Semi-Skilled/Professionals
- Family Men
- Non-Criminals
- Non-Pathological
- Enlisted



Other Terrorist Common Traits

- **Globally aware - spoke 3 or 4 languages**
- **Upwardly and geographically mobile**
- **Expatriates from Arab countries**
- **Lonely and marginalized life**
- **Mosque attendance for socialization**

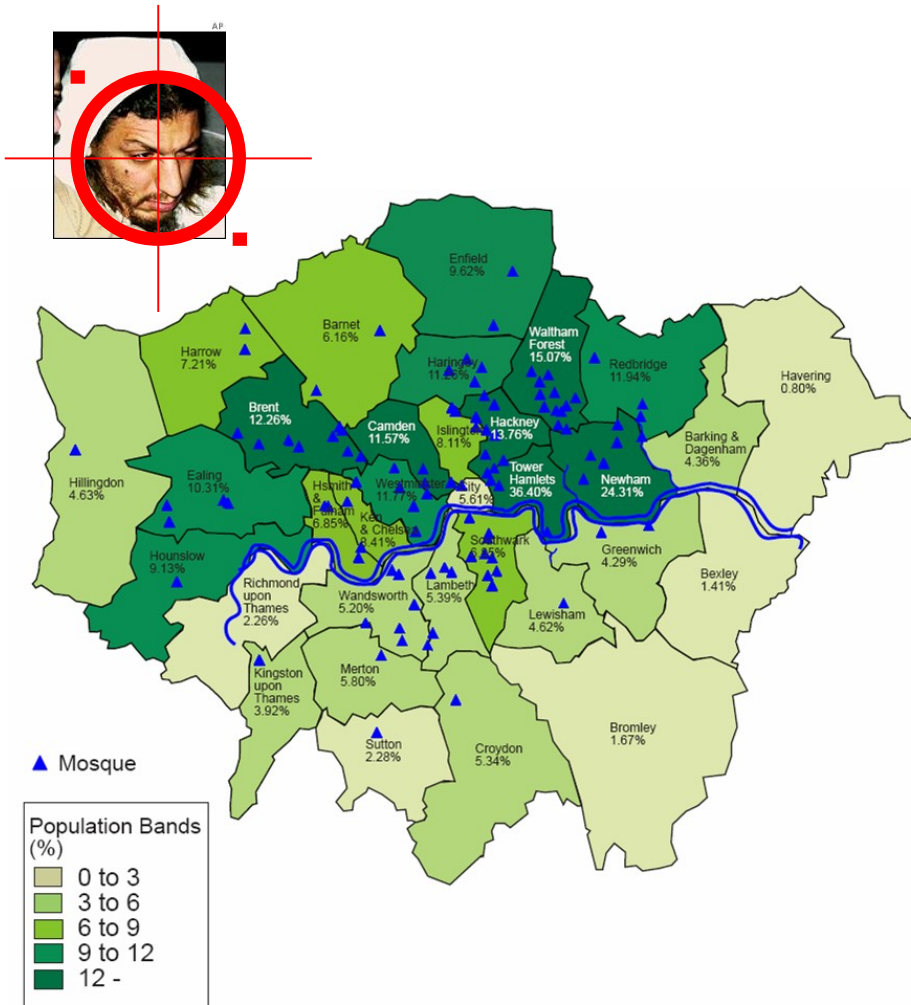
Terrorists emerged through “normal” social dynamics



GSJ Terrorists Widespread Among Cities

- London
 - » Finsbury Park Mosque**
 - » Baker Street Mosque****
- Brooklyn: Al Faruq Mosque**
- Milan: Islamic Cultural Center**
- Madrid: Abu Bakr Mosque**
- Hamburg: Al Quds Mosque**
- Roubaix: Al Dawah Mosque**
- Montreal: Assuma Mosque**
- Asir, Saudi Arabia: Al Seqley Mosque**

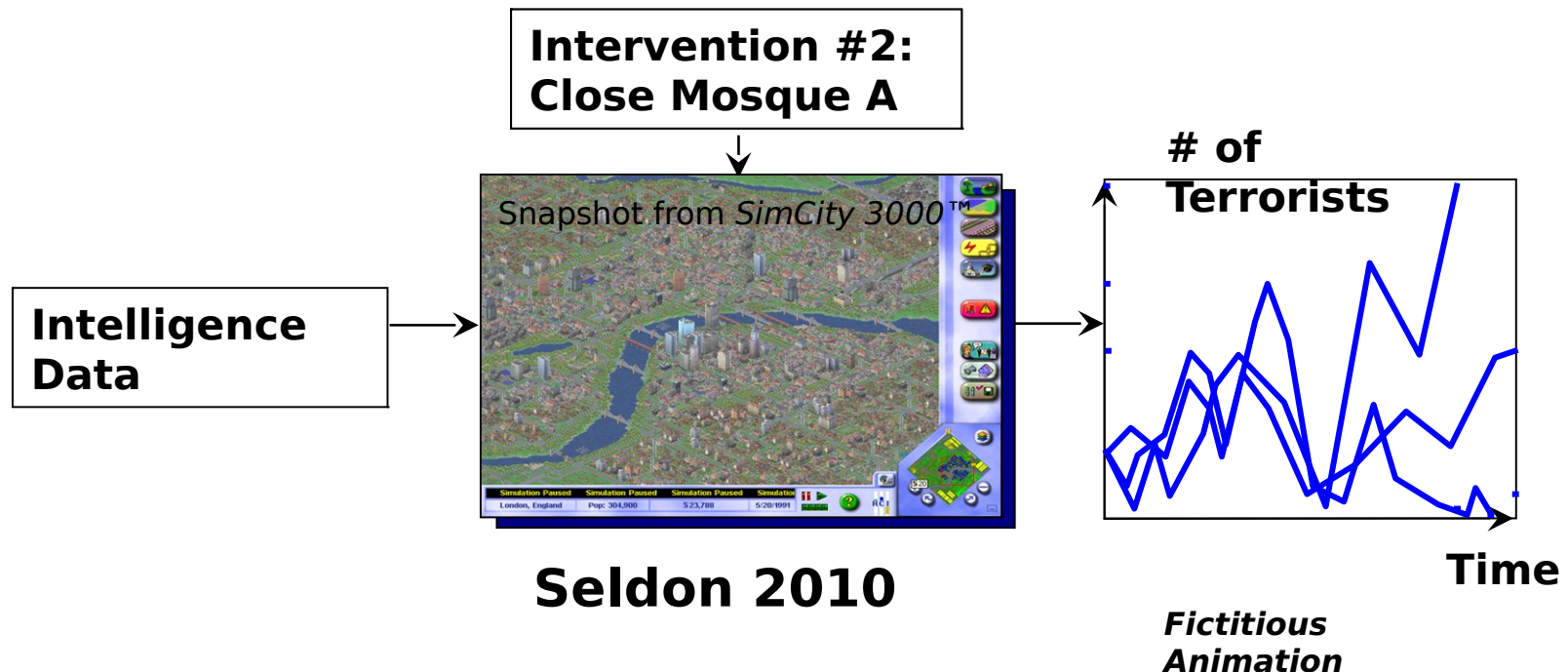
London as example



- **Population 7.2 million**
- **600,000 Muslims**
- **160 Mosques**
- **100s-1000s of potential embedded terrorists**

Seldon: Computational Social Simulation

- Social dynamics through agent-based modeling
- Provides insights into the factors and processes that lead to emergence of terrorist organizations
 - ✓ Hypotheses and theories
 - ✓ Test intervention strategies

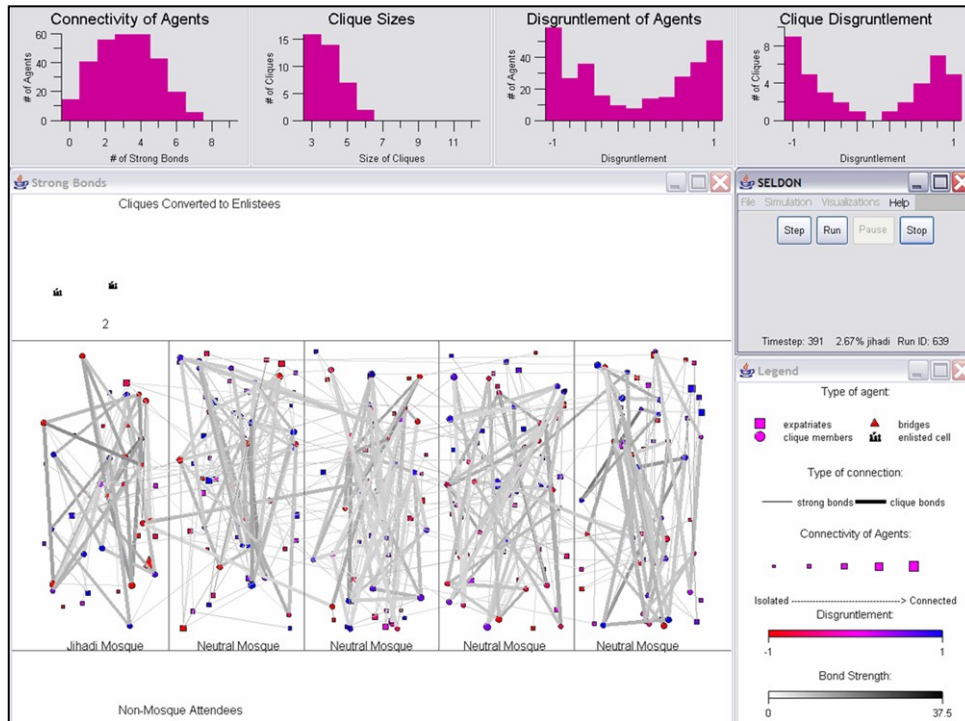




Terrorist Agent-Based Modeling Projects

	Socioeconomic Model (MacKerrow)	DYNET (Carley)	Project Albert (USMC)	Biowar (Carley)	Seldon 2004 (SNL)
Simulation Type	MidEast Grievance	Disrupt. of Terror Orgs	Battlefield Tactics	U.S. Urban BioAttack	Terrorists Enlistment
# of Agents	1000s	12	30 to 50	260,000	200 to 1000
Time Steps	Day	(Day)	Seconds	4 hrs	Day
Adaptation	Game Theory	(Yes)	No	No	No
Social Networks	Dynamic & Multiple	Dynamic	No	Static	Dynamic & Multiple
Clique Formation	(Yes)	No	No	No	Yes

Seldon Terrorist Enlistment Model



- **Sageman Model of GSJ terrorists emergence process**
 - **Agent-based model**
 - **Dynamic multiple social networks**
 - **Clique emergence and evolution**
 - **Multi-scale agents**
- **How to disrupt terrorist pipeline?**
- **How to better find terrorists?**



Sageman Enlistment Pipeline

**Expatriated and
Isolated Individual**



Attends Mosque



Makes “Friends”

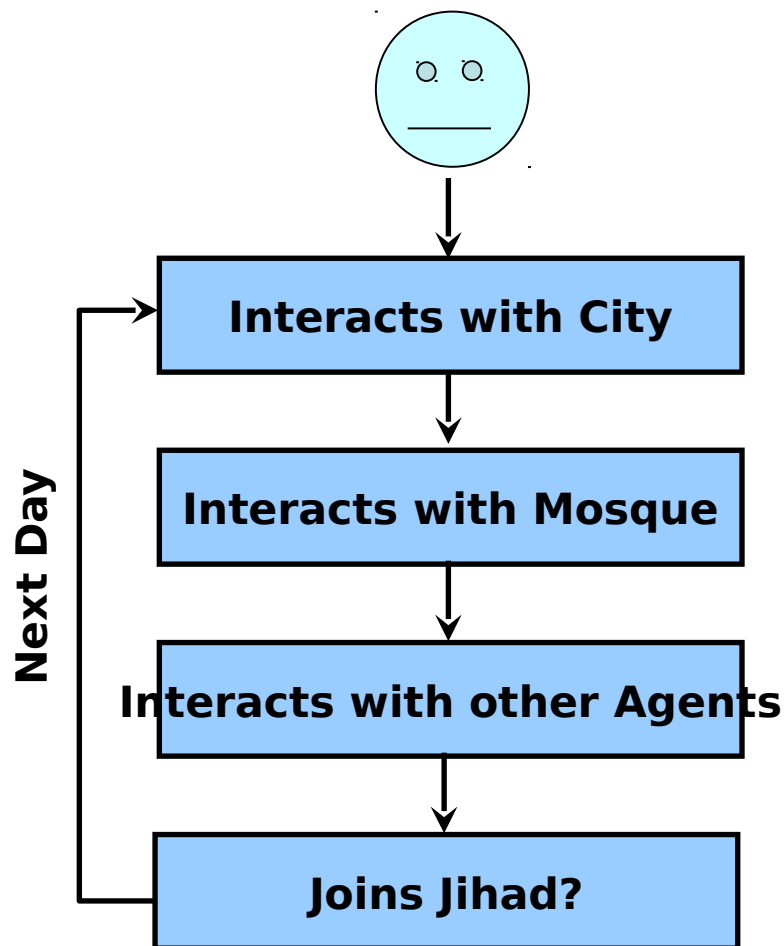


Forms Clique

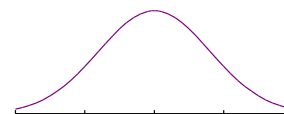


Meets Jihad Agent and Enlists

Seldon Implementation of Sageman Pipeline



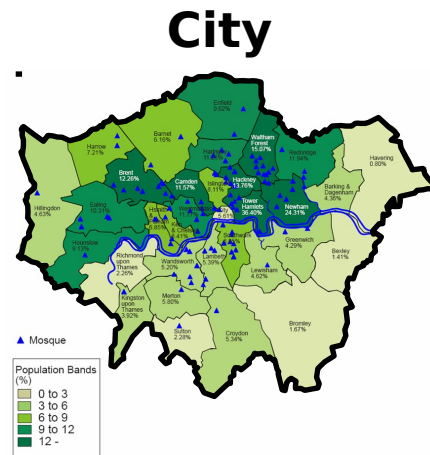
- **Agent's key attribute is Disgruntlement (D)**



Initial Normal Dist.

- **Multiple Social networks**
 - **Clique**
 - **"Friend"**
 - **Acquaintance**
 - **Mosque**
 - **City**

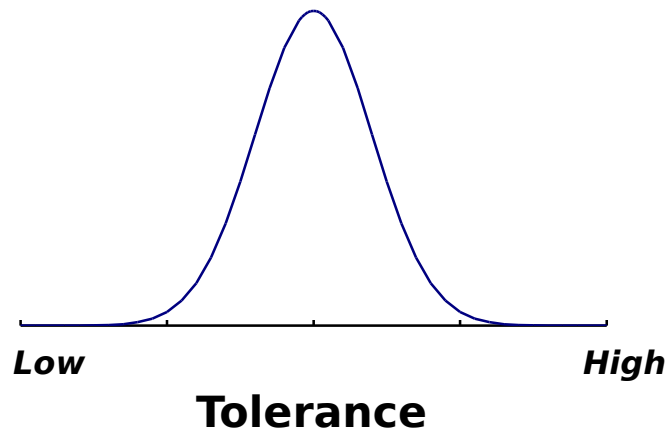
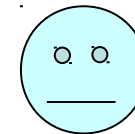
City - Agent Interaction



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Agent

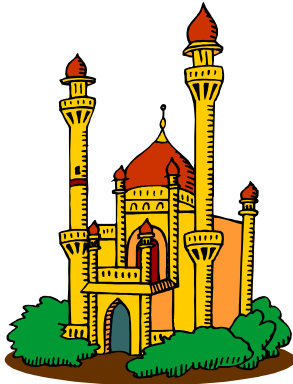


High Tolerance = $\downarrow p$

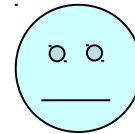
Low Tolerance = $\uparrow p$

Mosque - Agent Interaction

Mosque



Agent



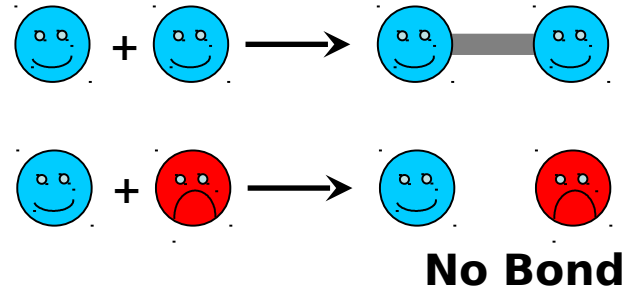
- **Jihadi Mosque:** $\uparrow D$
- **Neutral Mosque:** $\downarrow D$

D = Agent Disgruntlement

Agent-Agent Interaction Rules Guided by Social Science Research

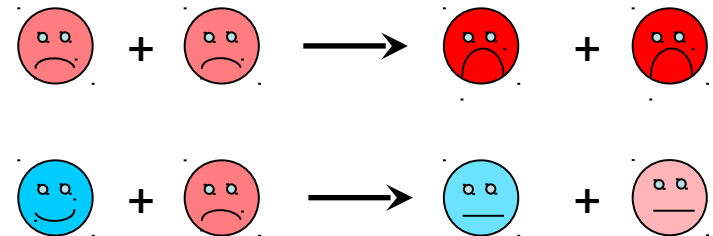
1. Agents bond with similar agents, aka - homophily.

- Strong support in literature (Byrne 1971; Deutsch and Mackesy 1985; Fargas 1985; Kenny and Kashy 1994; Locke and Horowitz 1990)
- Variable strength bonds



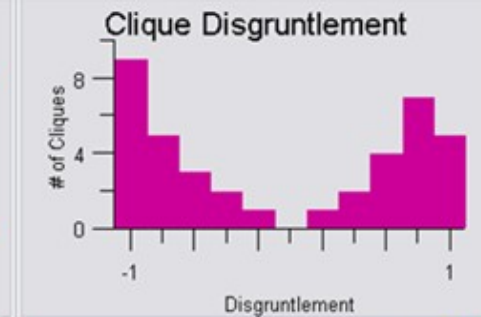
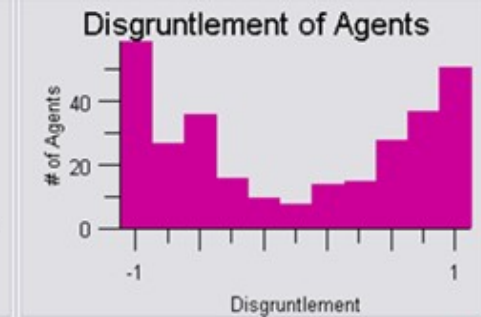
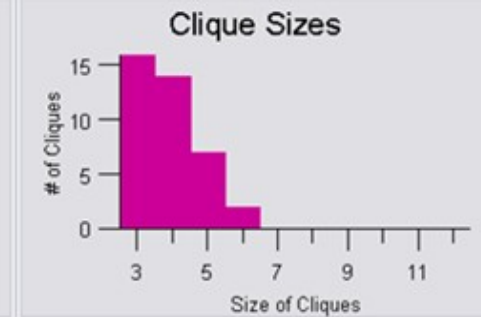
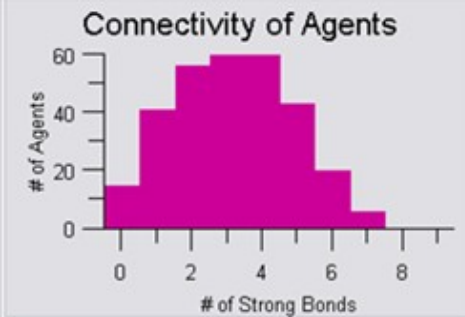
2. Social transmission of emotion, or attitudinal convergence

- Great deal of literature on emotional contagion (Anderson et al. 2003; Hatfield et al 1993; Doherty 1997; Hess and Blairy 2001; Strack and Coyne 1983; Gotlieb and Robinson 1982)

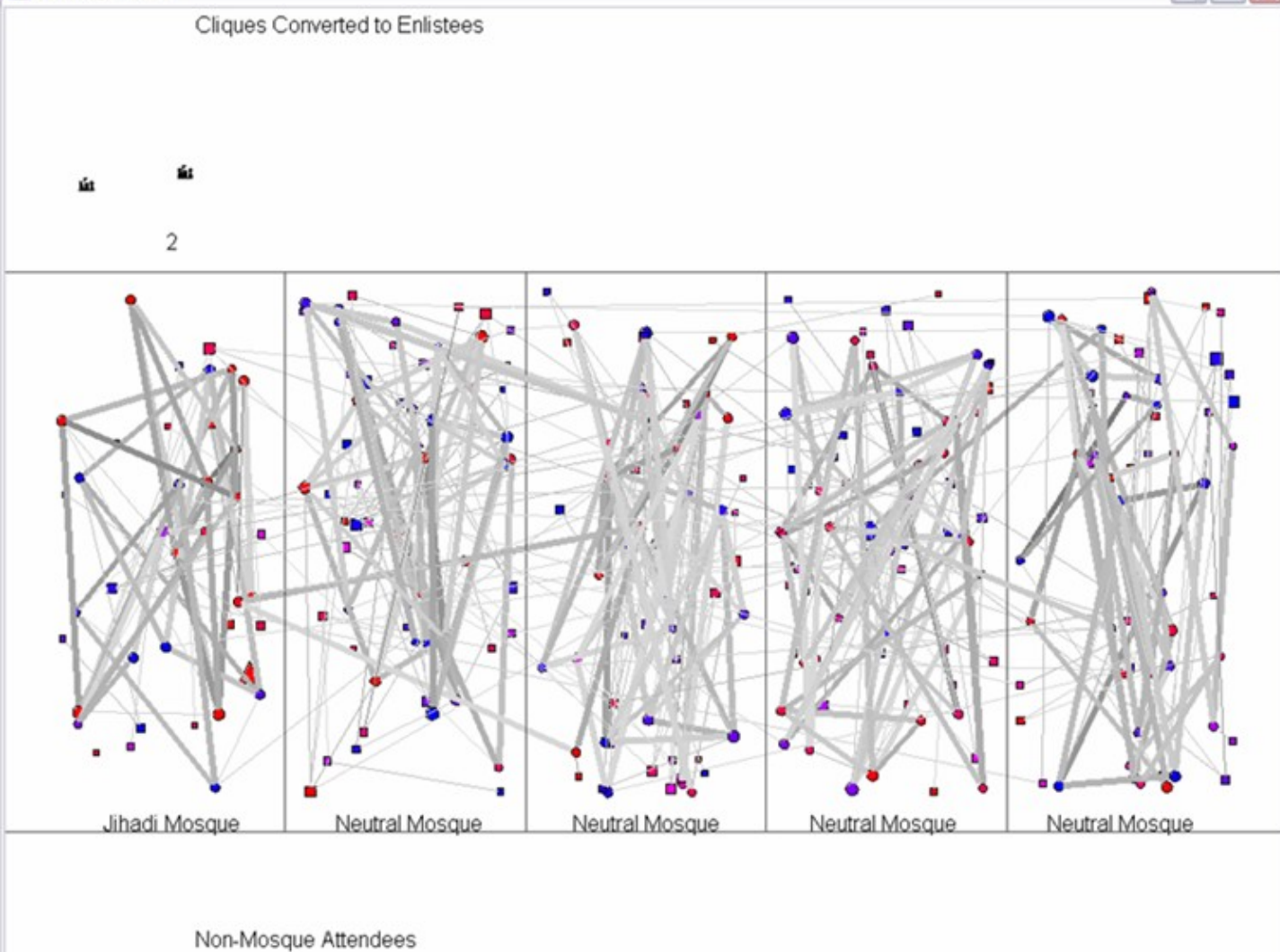




Demonstration



Strong Bonds



SELDON

File Simulation Visualizations Help

Step Run Pause Stop

Timestep: 391 2.67% jihadi Run ID: 639

Legend

Type of agent:

- expatriates (pink square)
- clique members (pink circle)
- bridges (red triangle)
- enlisted cell (black icon)

Type of connection:

- strong bonds (thin grey line)
- clique bonds (thick black line)

Connectivity of Agents:

Isolated Connected

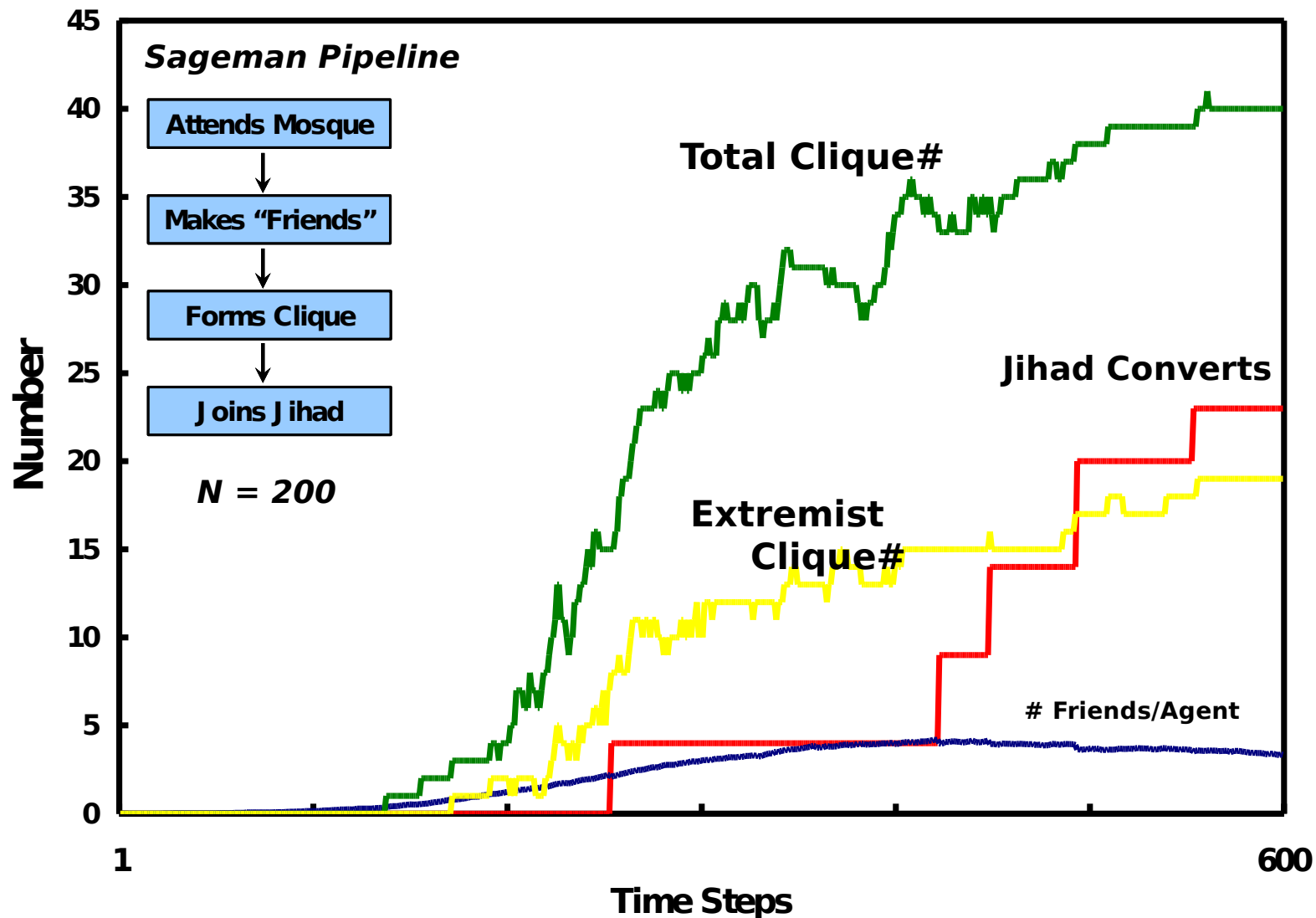
Disgruntlement:

-1 1

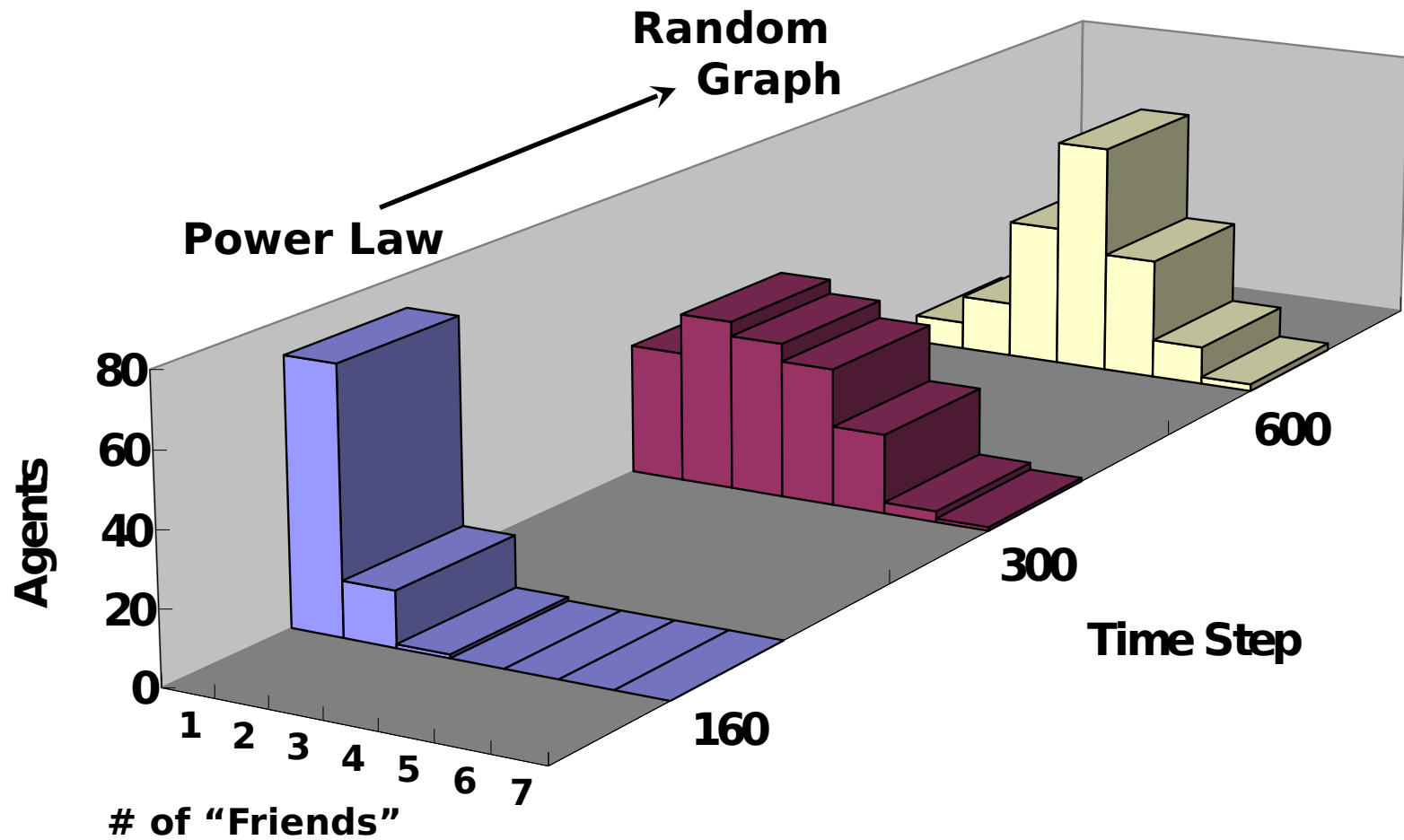
Bond Strength:

0 37.5

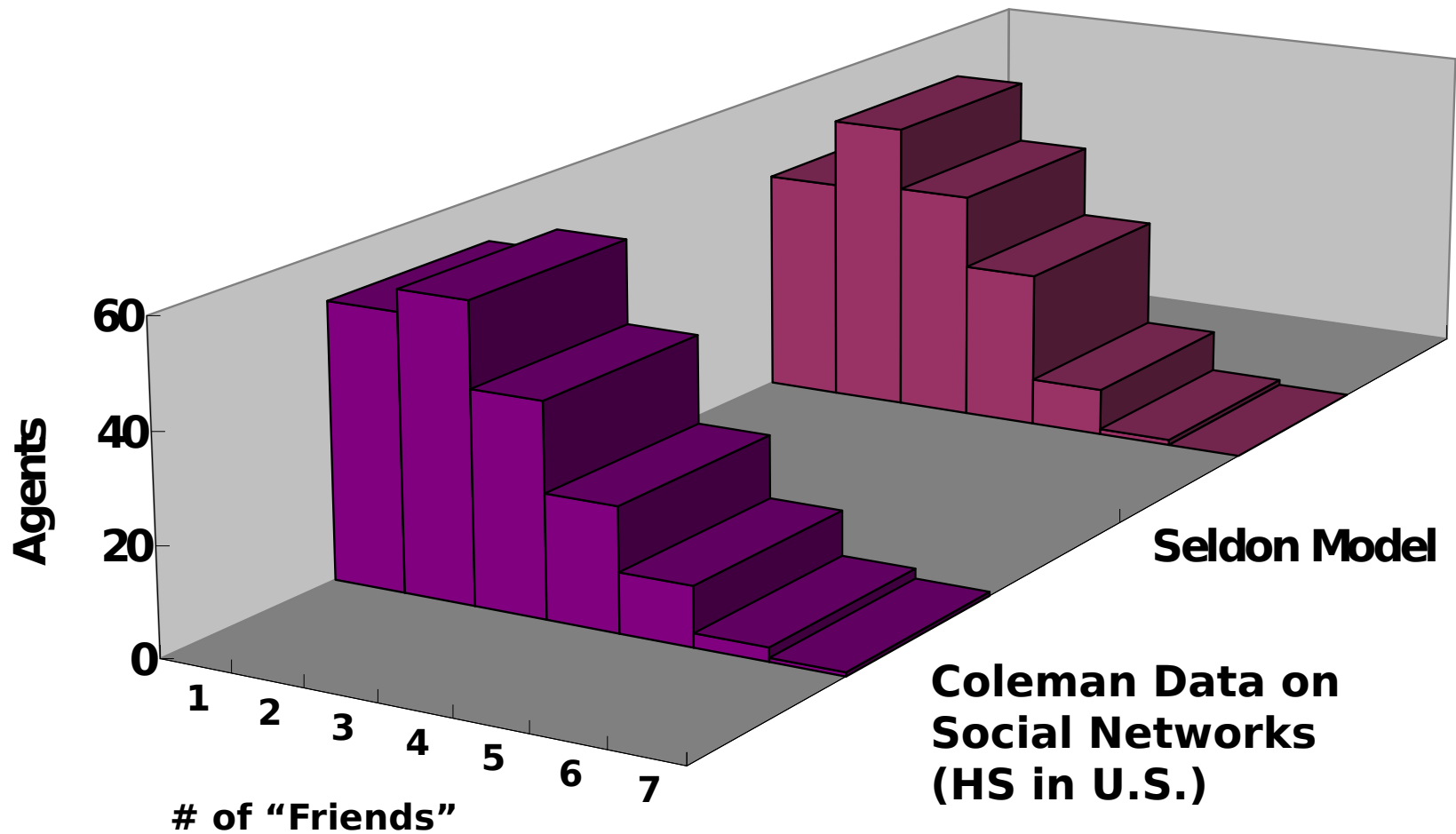
Emergence of Jihad Agents from Seldon



Social Network Emergence

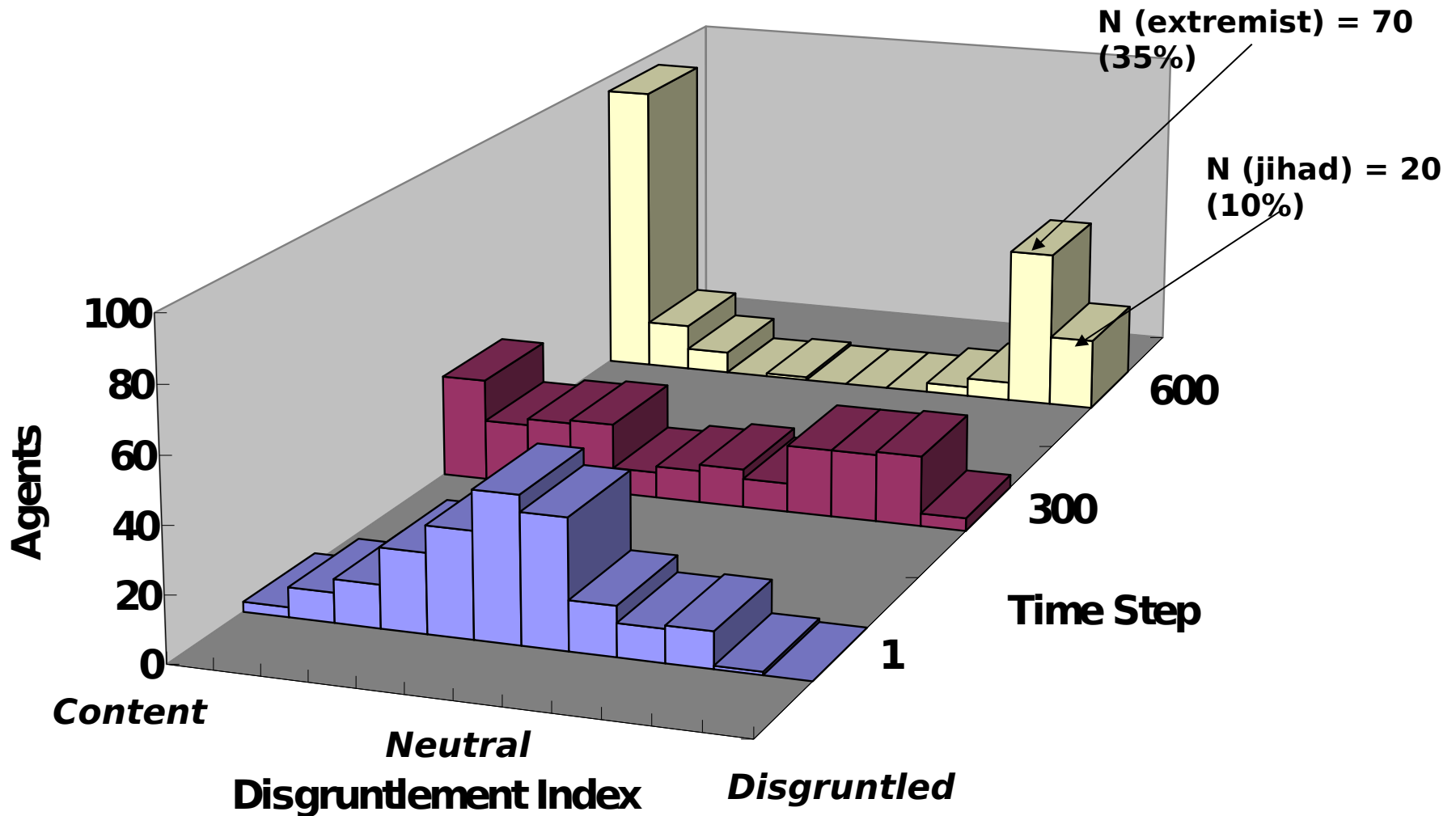


Seldon Network Compared to Coleman Data

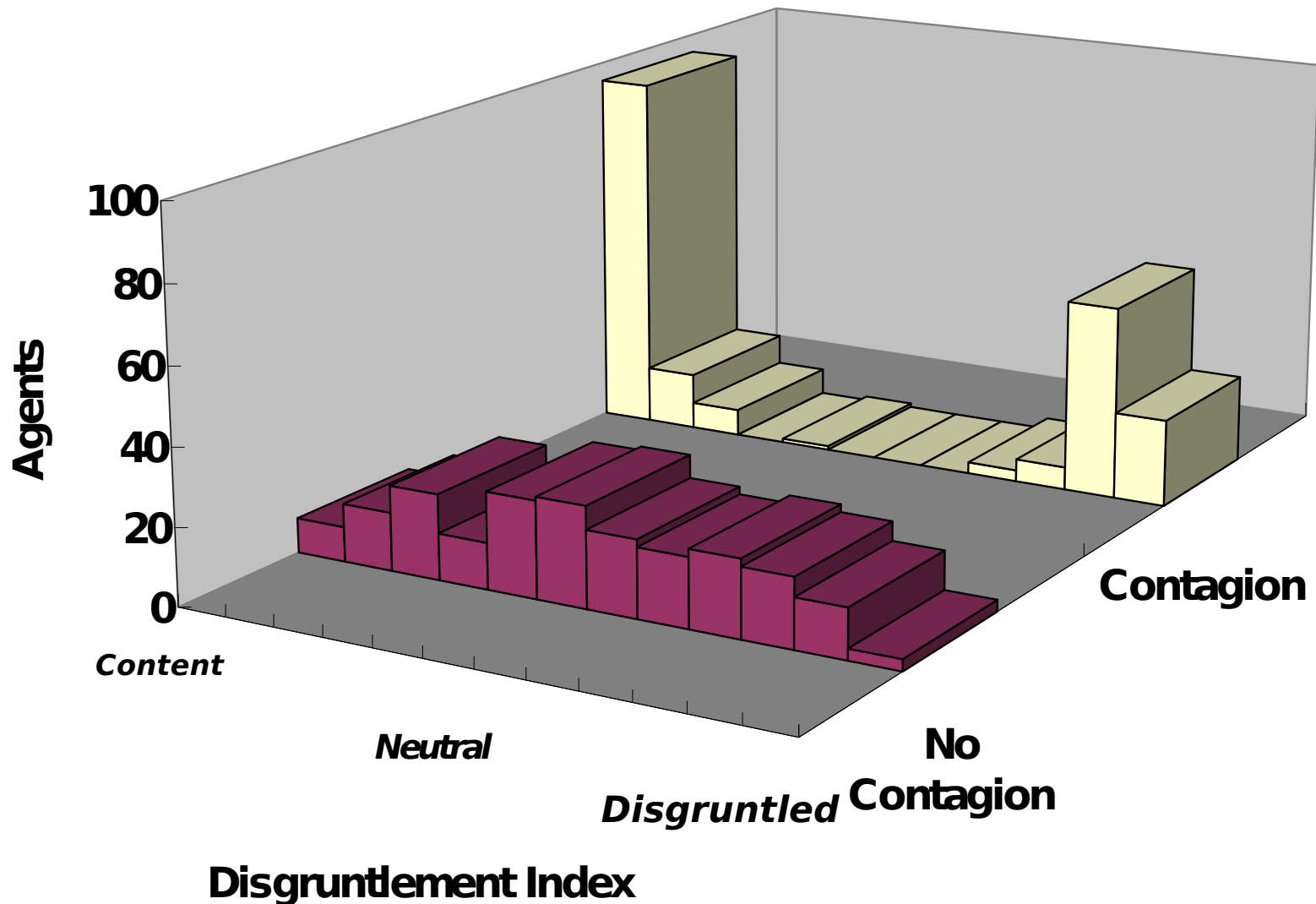


Coleman, James S. *The Adolescent Society*.
The Free Press of Glencoe, New York, 1962

Disgruntlement Polarization

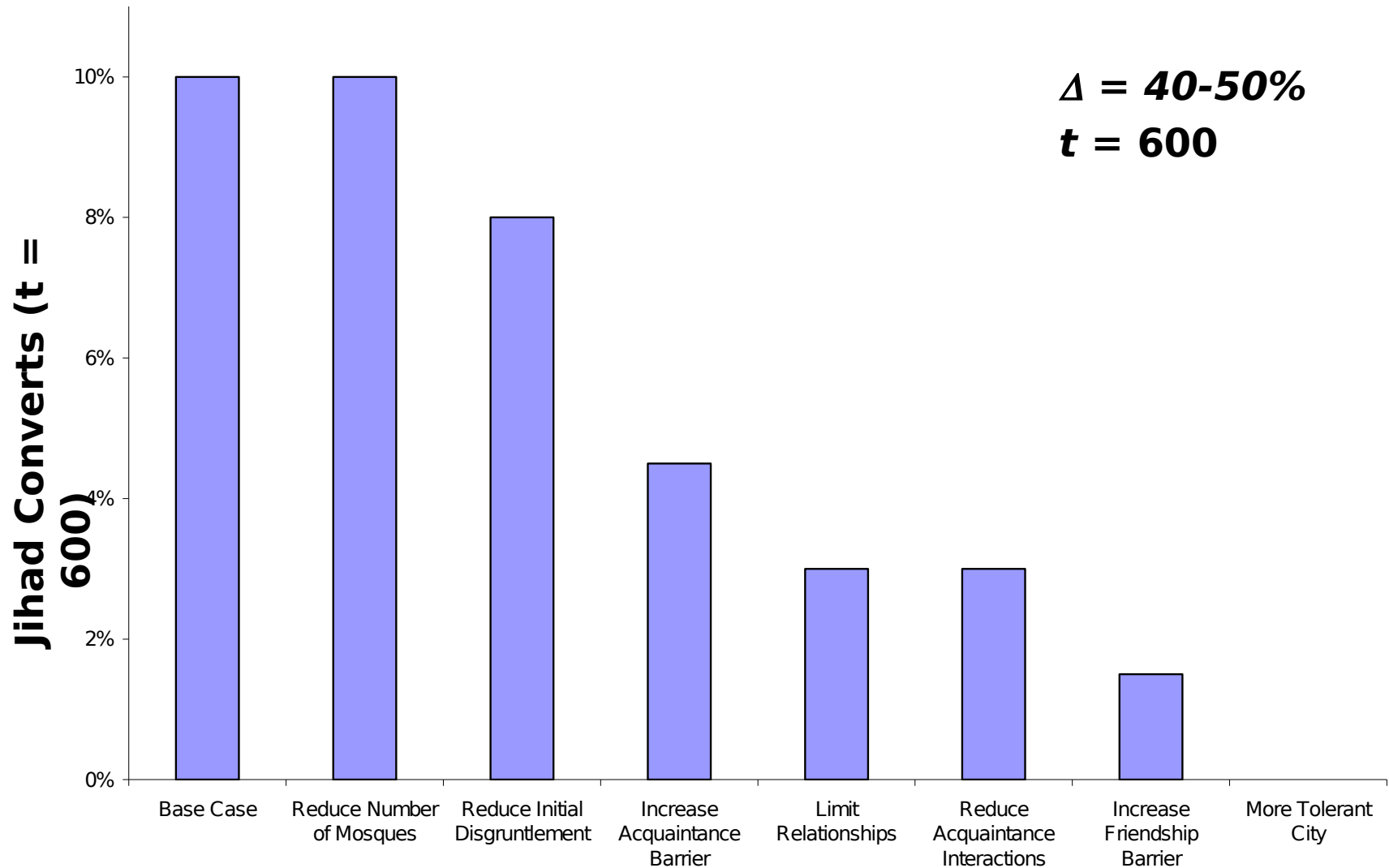


Polarization Driven by Emotion Contagion

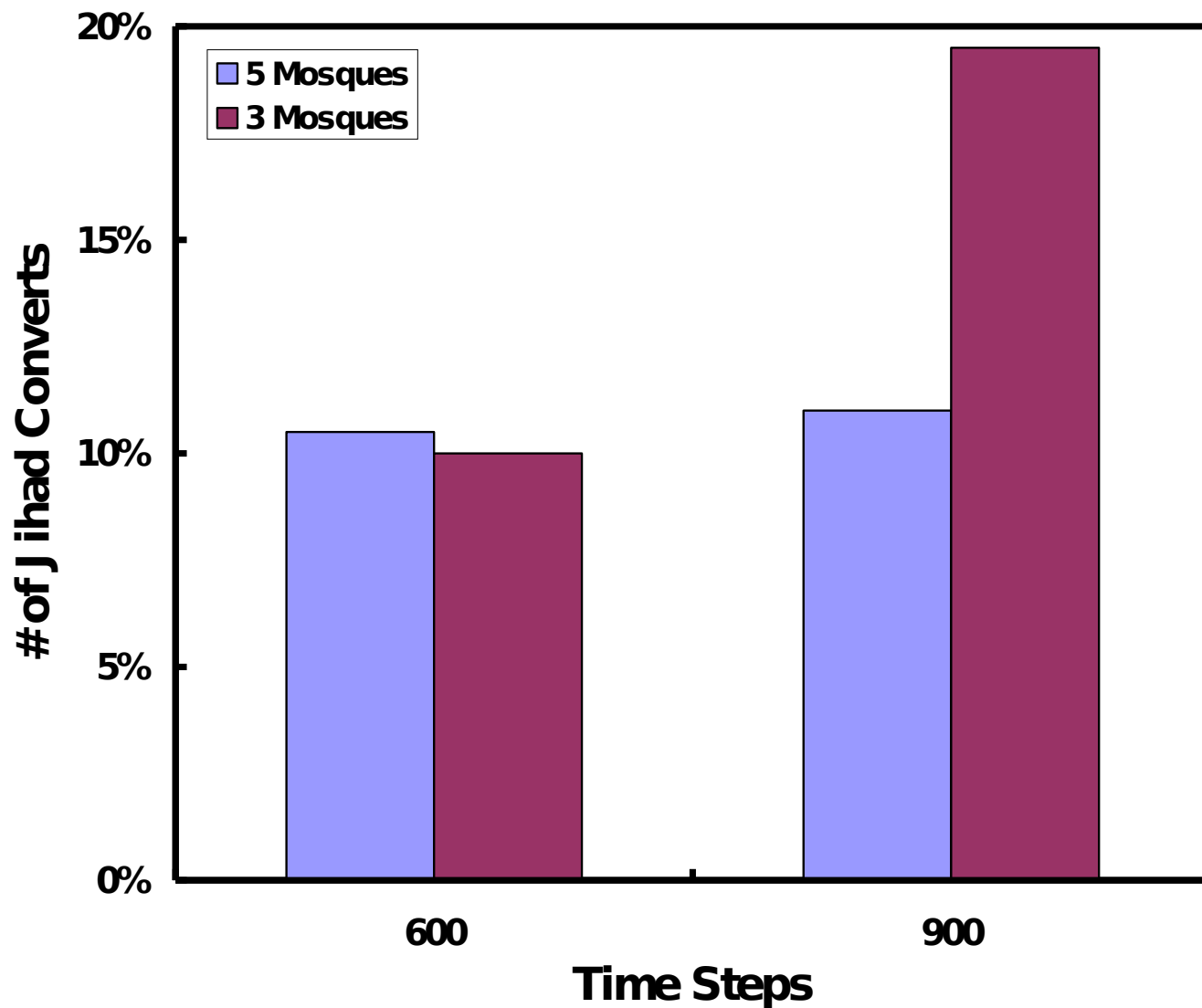




Testing Intervention Strategies

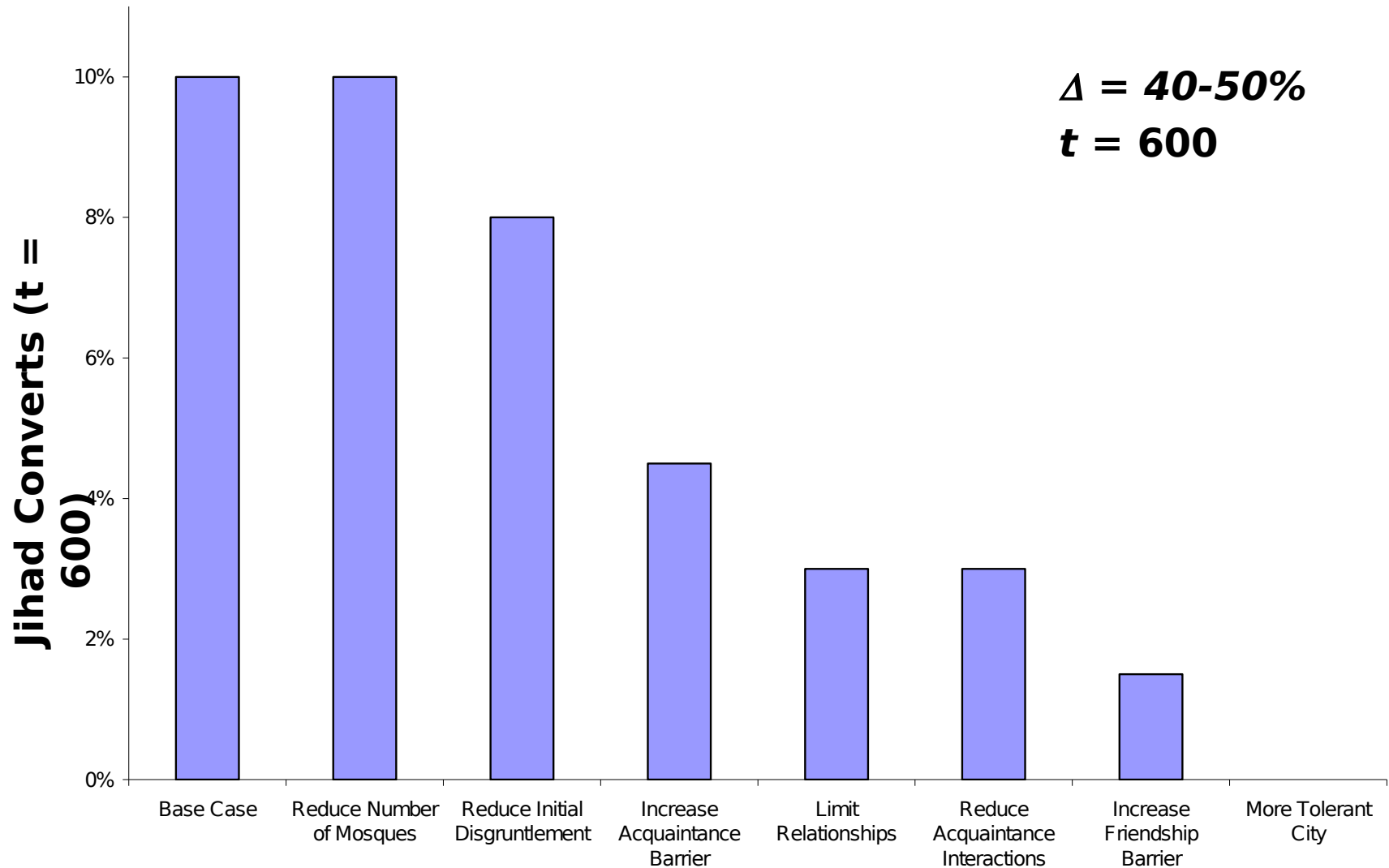


Reducing number of mosques is risky





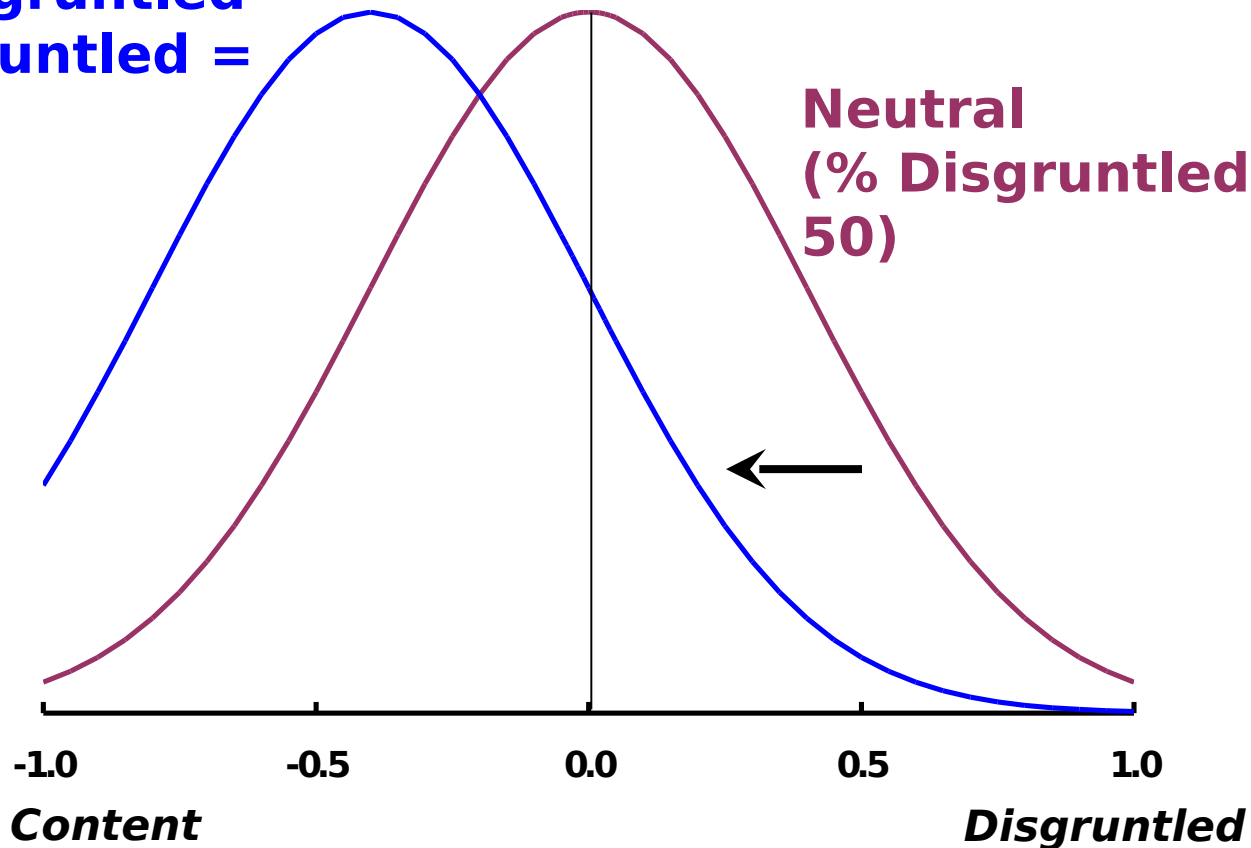
Testing Intervention Strategies



Decrease Initial Disgruntlement

**Less Disgruntled
(% Disgruntled =
16)**

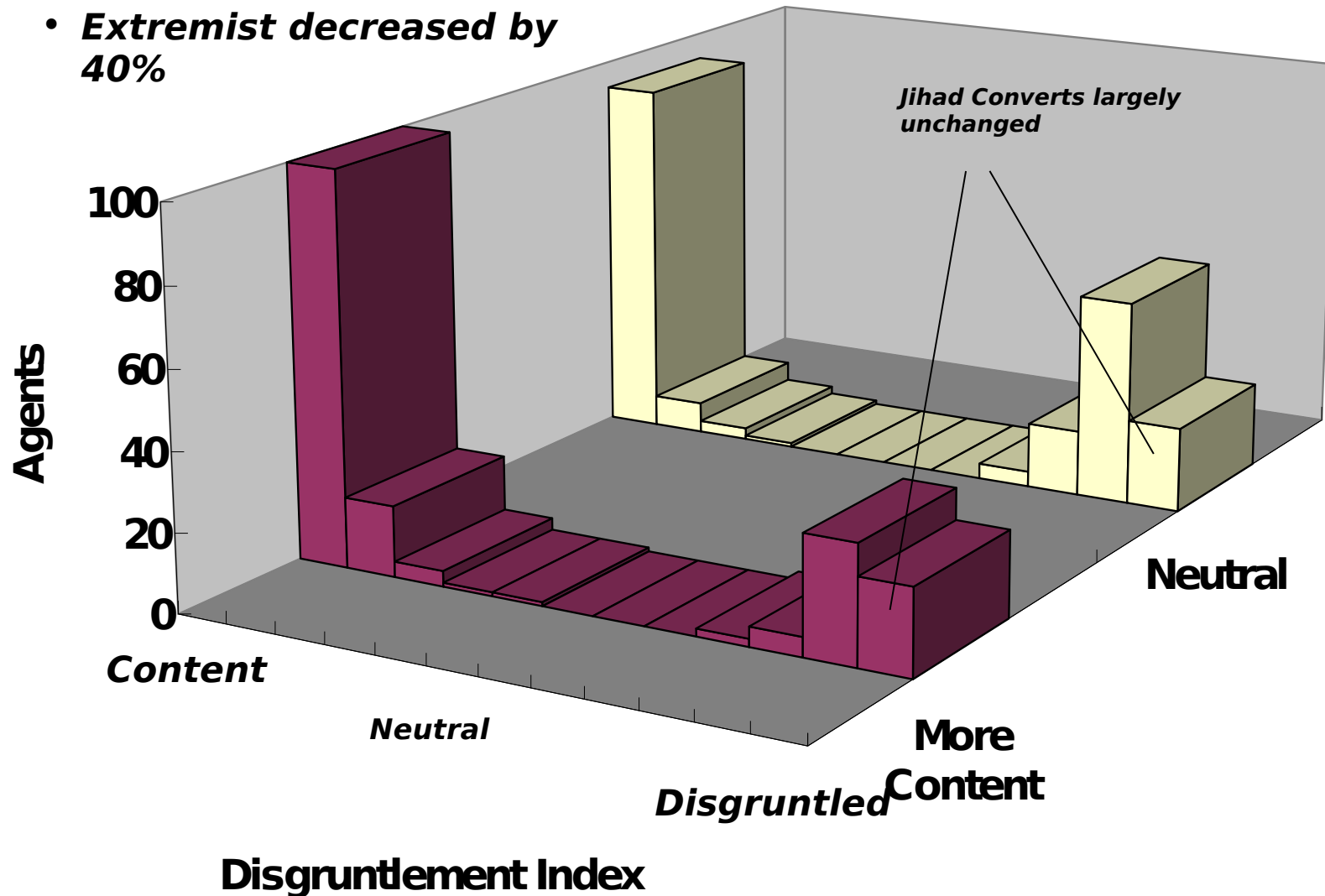
**Neutral
(% Disgruntled =
50)**



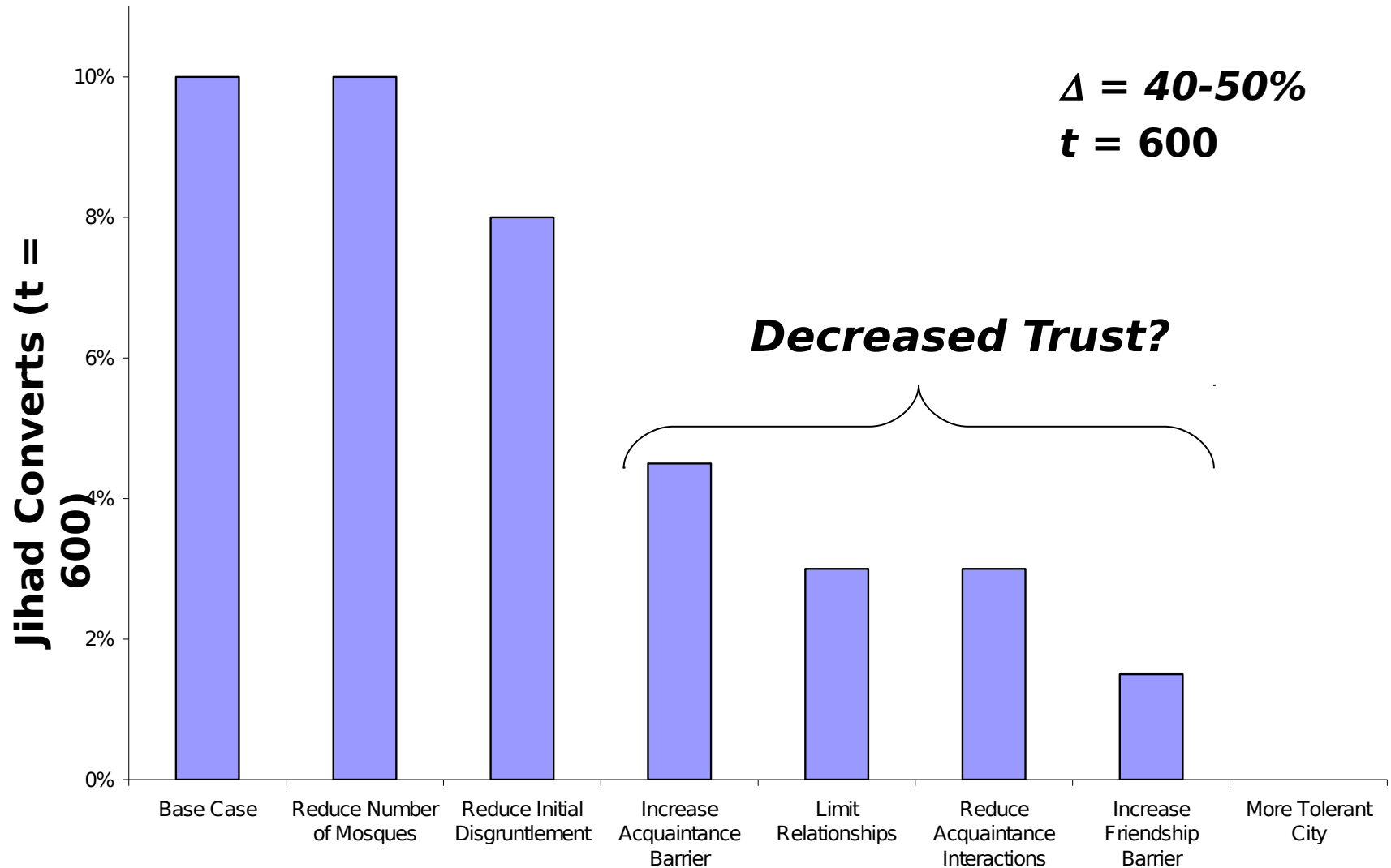
Disgruntlement Index

Reducing Disgruntlement Semi-Effective

- *Extremist decreased by 40%*



Testing Intervention Strategies





Seldon recapped

- **Illustrates value of computational social simulation in future U.S. threat environment**
 - **Insights into relative importance of factors and processes for terrorist emergence**
 - ✓ **Society tolerance of immigrants**
 - ✓ **Influence of mosques**
 - ✓ **Barriers to clique formation**
 - ✓ **Unfocused policy aimed at general population**
 - **Platform for testing intervention strategies**



Seldon is incomplete

- **Reactive Agents**
- **One set of behavior rules for individual agents**
- **No actual data used**
- **Sub-models uncalibrated (no diachronic data)**
 - **Interactions → social bonds**
 - **Clique formation**
 - **Attitudinal convergence**
 - **Inter-Mosque movement**
- **Kinship networks largely ignored**
- **One individual agent-type (Arab men expats)**



Path Forward

Year 1

- Apply Seldon to one data-rich neighborhood and validate
 - Endow agents with real distribution of attributes
 - Initialize with pre-existing social networks
- Develop simple agent adaptation (game theory or G.A.)
- Refine and calibrate social sub-models (continuous process)

Year 2

- Extend Seldon to data-rich city and validate
- Add key model components
 - Economic and resources sub-models
 - New agent types (e.g. - females and kin)
 - Kinship networks
 - Inter-group networks
- Begin developing simple cognitive model



Path Forward (cont'd)

Year 3

- **Develop Regional Seldon (e.g. - Germany) and validate**
 - **Coordinated Multi-Cities**
- **Continue with cognitive model and learning algorithms**

Year 4-5

- **Implement cognitive models for truly complex and adaptive system analysis.**



SELDON completed

- Identifies...
 - Which parts of the process are most critical
 - Help focus efforts to disrupt the process
 - What kinds of people will be attracted at which points in the process
 - Help focus interdiction efforts
- *SELDON can be a critical strategic tool to assist U.S. in stopping terrorists in the near term AND... possibly new socially emergent threats in the long term.*